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An Engineering Research and Administration Building for Clemson University

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AN ENGINEEERING RESEARCH AND ADMINISTRATION BUILDING FOR CLEMSON UNIVERSITY

by

Scott Disher

A terminal project submitted to the Faculty of the College of Architecture, Clemson University in partial fulfillment of the requirements for the degree of

Bachelor of Architecture

May 1984

Approved:

[redacted]

Major Advisor

[redacted]

Head, Dept. of Architectural Studies

[redacted]

Dean, College of Architecture

TABLE OF CONTENTS

Project Description

PROJECT DESCRIPTION

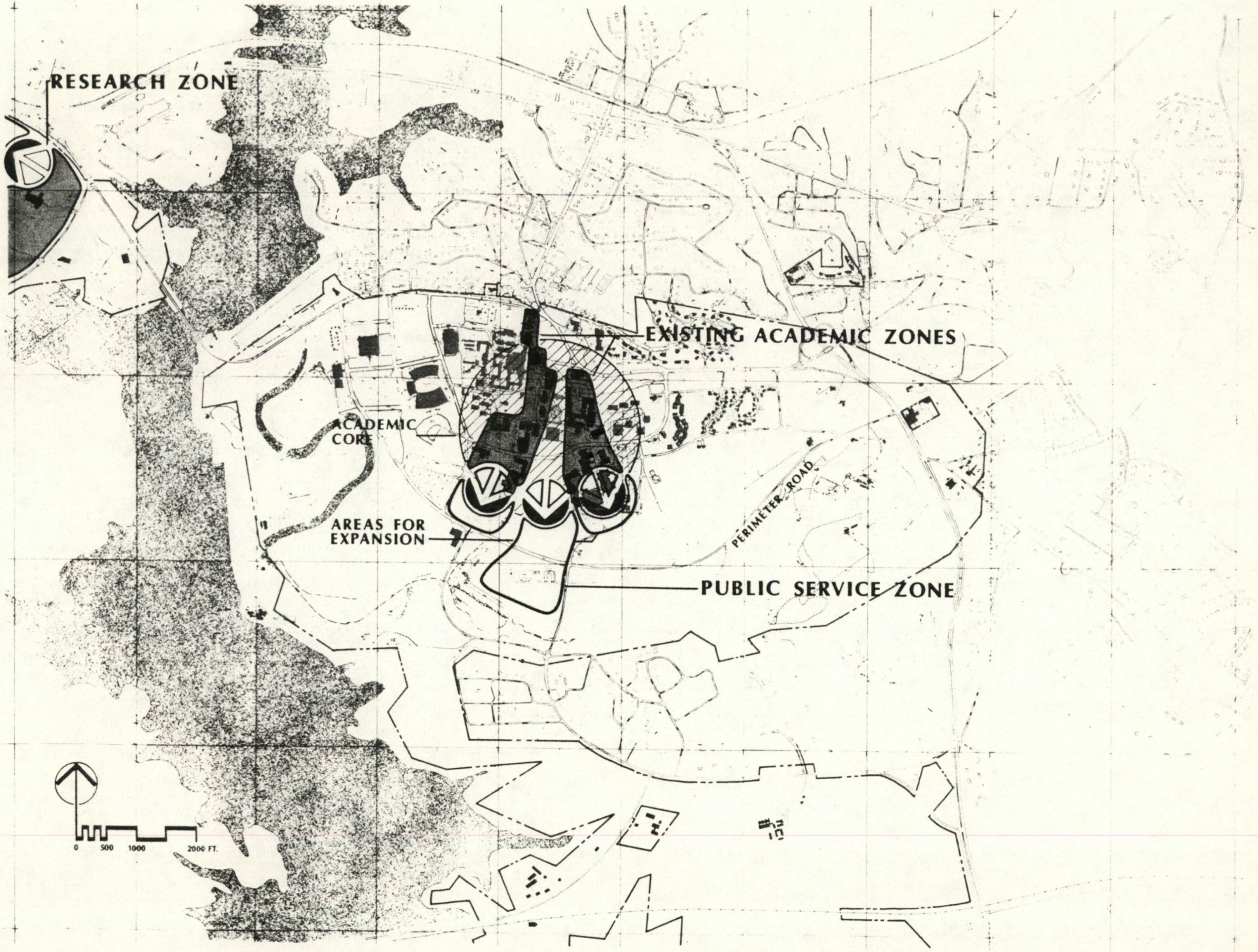
A new Engineering Resources Building of approximately 100,000 square feet, located on the campus of Clemson University, Clemson, S.C., is to be programmed and designed to meet the needs of an expanding College of Engineering. The scope of the project includes research facilities and a consolidated administrative group to accommodate Mechanical, Electrical and Computer Engineering staff and faculty.

Campus Growth

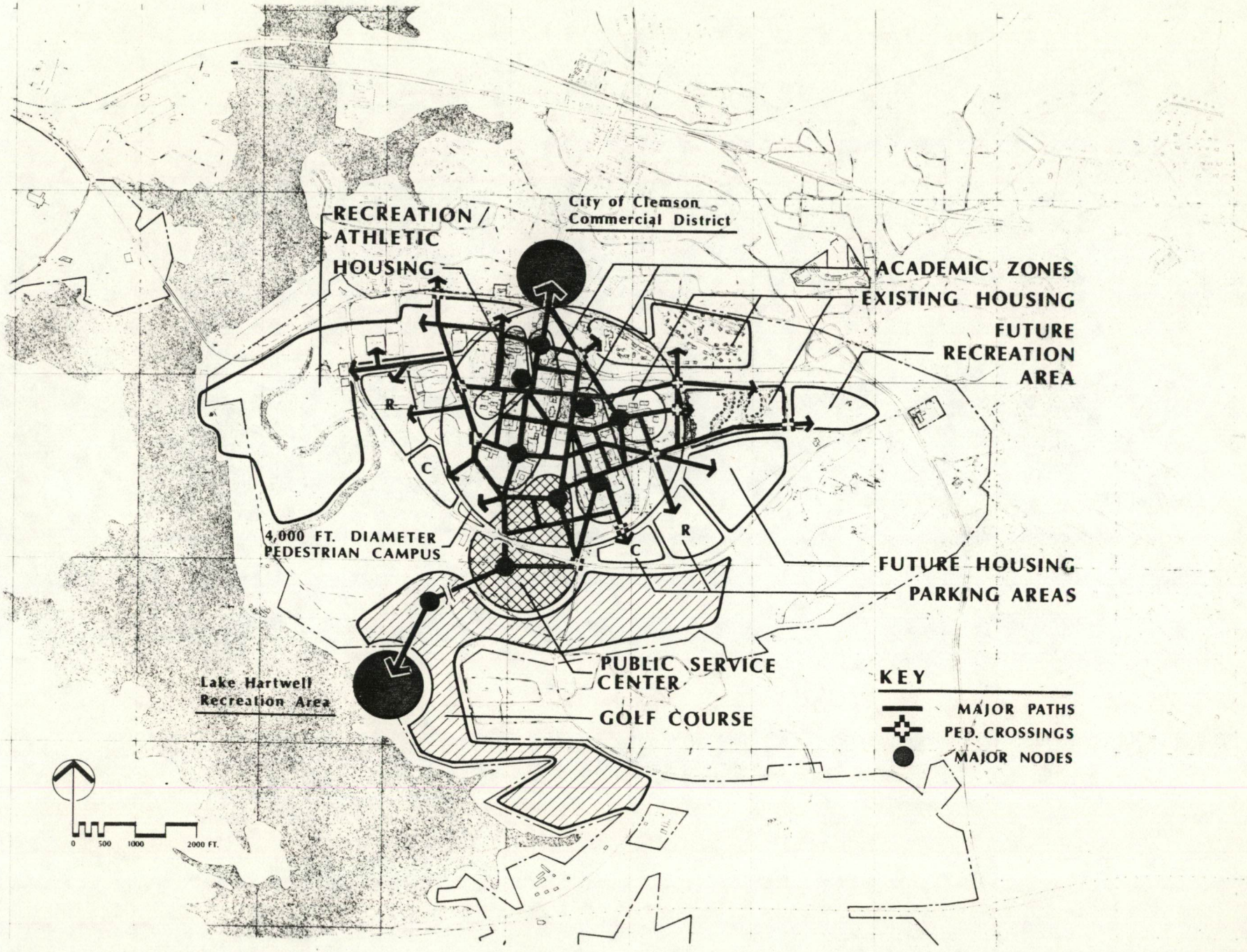
CAMPUS GROWTH

Begun in 1893 with 446 male students, Clemson University has grown to an enrollment of 11,000 co-ed students. Enrollment grew from slightly more than 3,300 to nearly 11,000 in the 30-year period from 1950 to 1980.

In an attempt to give order to this growth, several master plans have been developed and discarded over the years due to unforeseen changes and growth. Faced with the need to make effective planning decisions, the University obtained funding for a Comprehensive Master Plan Study. Unlike previous master plans the current study is not a rigid map but a tool and process that could be used by the Clemson community to create a coherent environment--one that is responsive to change and to the goals and objectives of its inhabitants.



Conceptual Framework Plan - Program Growth



Conceptual Framework Plan - Pedestrian Campus

The Site

CLEMSON UNIVERSITY CAMPUS

THE SITE

In concert with the axial expansion of the academic core to the south, shown in the conceptual program growth of Clemson's campus, and by virtue of its location to the existing Engineering complex, the area between Lee Hall and Earle Hall becomes best suited for expansion of the Engineering facilities. With the construction of the new Chemistry Building in the corner between Fernow Street and Palmetto Boulevard, a new campus academic node will be created.

Site Analysis:

A. The view to the south provides contrast with campus core and connection to rural landscape.

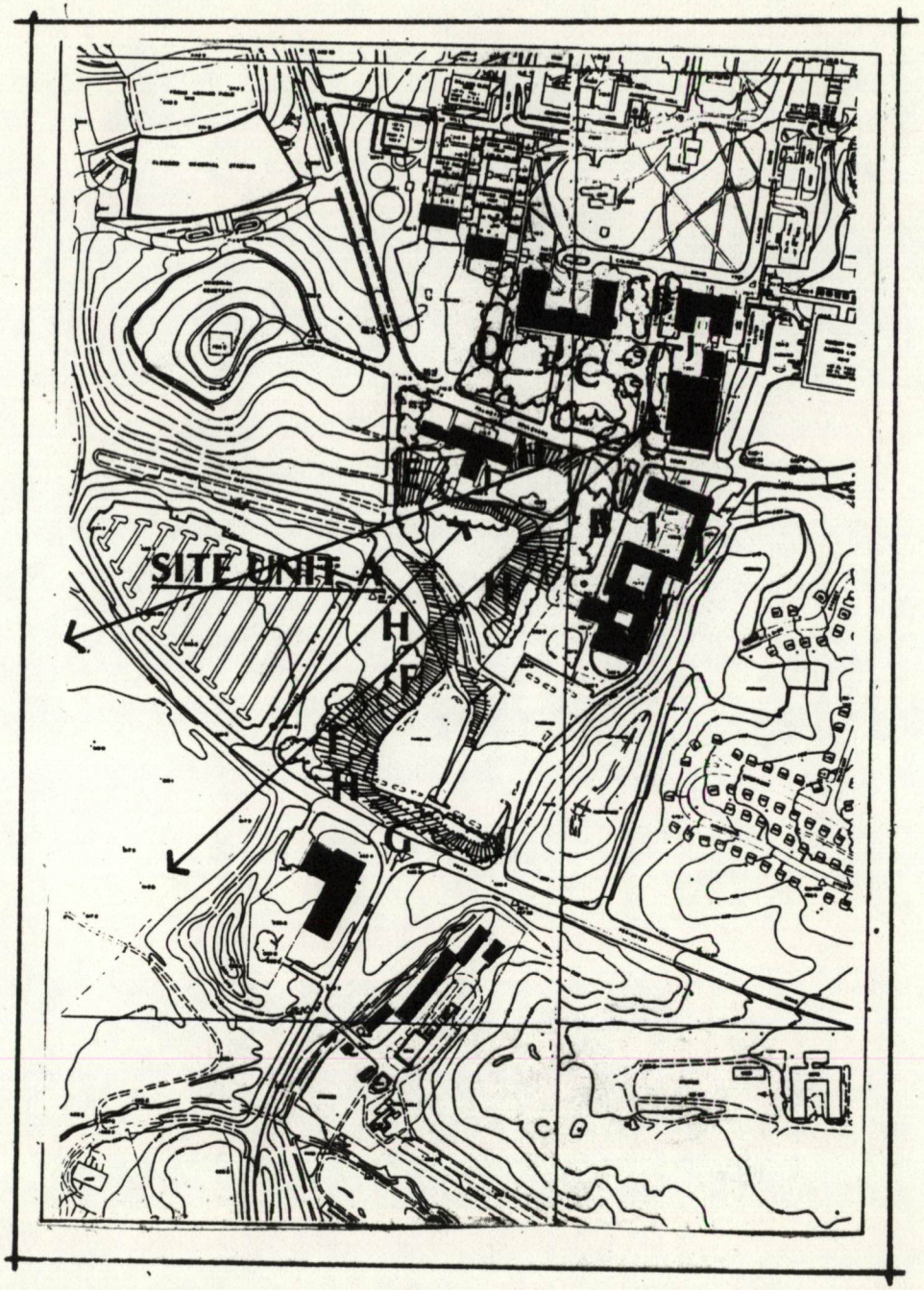
B. Hardwoods along Fernow Street and Lee Hall entrance provide pleasant streetscape.

C. Hardwoods south of Sirrine Hall provide shade for parking and de-emphasize service area.

D. Hardwoods along the walk west of Sirrine Hall and on the north side of Palmetto Boulevard provide a pleasant shaded pedestrian way and enhance the streetscape.

E. Hardwoods and pines southwest of Earle Hall stabilize the steep slope, soften the corner of Earle Hall and aid in the screening of the service area.

F. These hardwoods aid in stabilizing the slopes.



SITE ANALYSIS

Background

BACKGROUND

To alleviate the severe space shortages created by burgeoning Engineering and Computer Science enrollments and the rapid growth of computer requirements within instructional and research programs at Clemson, more Engineering space is needed.

The following data exemplifies the increased pressures on available space in the College.

A. College of Engineering enrollment has more than doubled since 1970 to 3,030 students.

B. Sponsored research expenditures, an indicator of research program size, have more than tripled since 1970 to over $3 million. Research growth trends show at least a doubling by the late 1980's.

C. Continuing Engineering Education activities have increased more than 15 times since 1970.

D. Growth will definitely continue in each mission area, limited only by available resources, including faculty, operating funds, and facilities.

E. Opportunities for closer university-industry ties for cooperative research are increasing.

F. No new or renovated space has been made available to the College of Engineering since 1970.

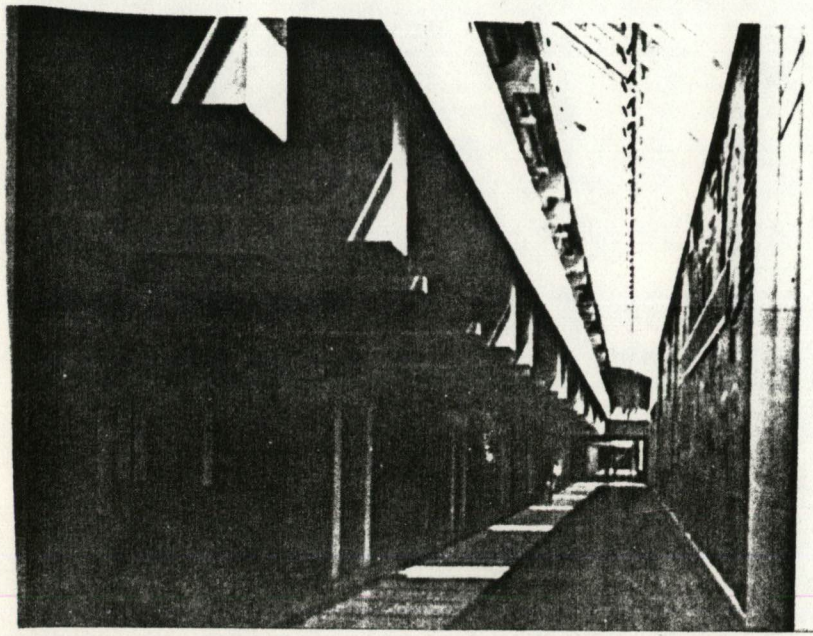
G. Based on available data, the College of Engineering ranks substantially below other leading Engineering colleges in the Southeast. Clemson's 90 SF per enrolled student compares with 100 SF to over 200 SF at other institutions.

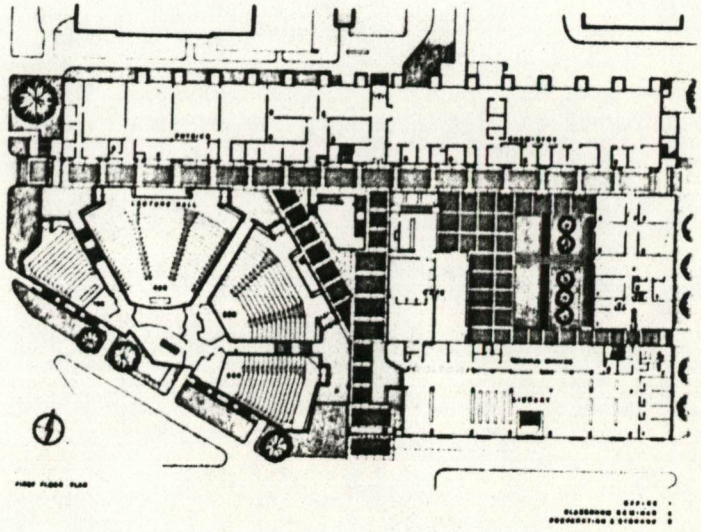
South Carolina is making a major commitment to recruit high technology industry. Existing industry is incorporating high technology systems including automated systems and robotics to improve productivity. All these new technologies demand a technological resource base of the first rank. Clemson is the technological leader for South Carolina and is continually looked to for its Engineering graduates, access to faculty expertise and for research support to solve critical problems.

Case Studies

CASE STUDY

Undergraduate Science Center at Harvard University
Cambridge, Massachusetts by Sert, Jackson and Associates - 1979



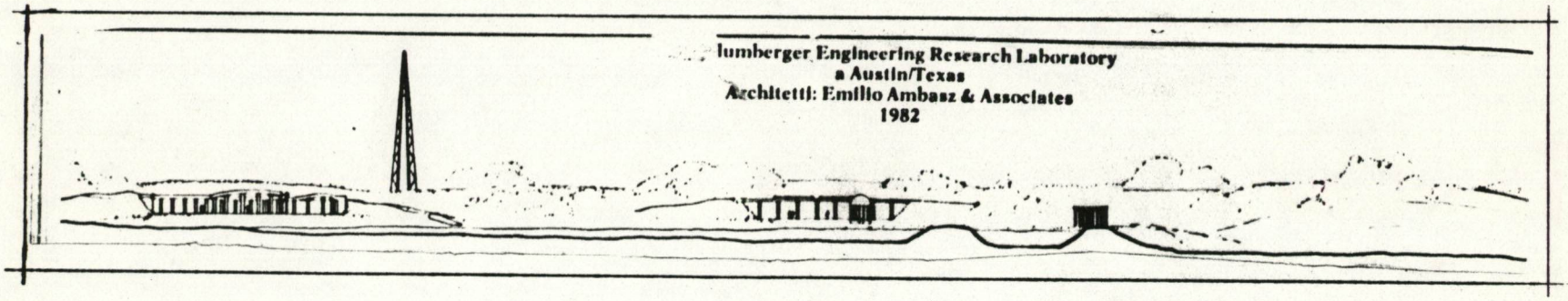


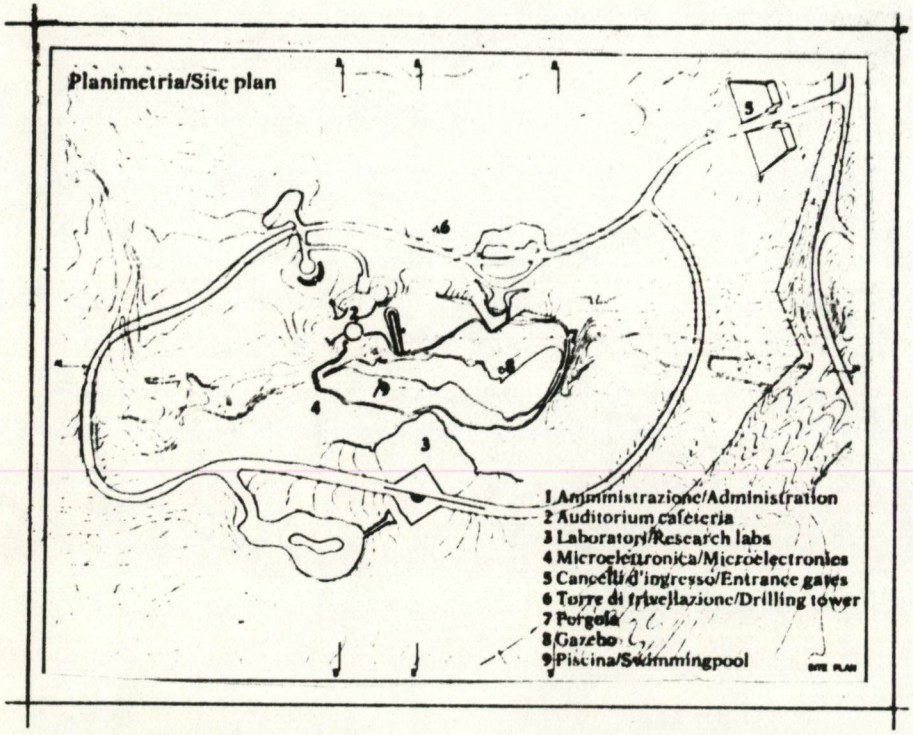
The program for the Undergraduate Science Center at Harvard University emerged after faculty members suggested that interest in the sciences could be heightened by a teaching concept that would provide for cross fertilization through close proximity of the various disciplines. The physical setting, designed by Sert, Jackson & Associates, Inc., Cambridge, Mass., reflects this concept by providing interiors that are an "appropriate science environment, attractive to students," the jury said.

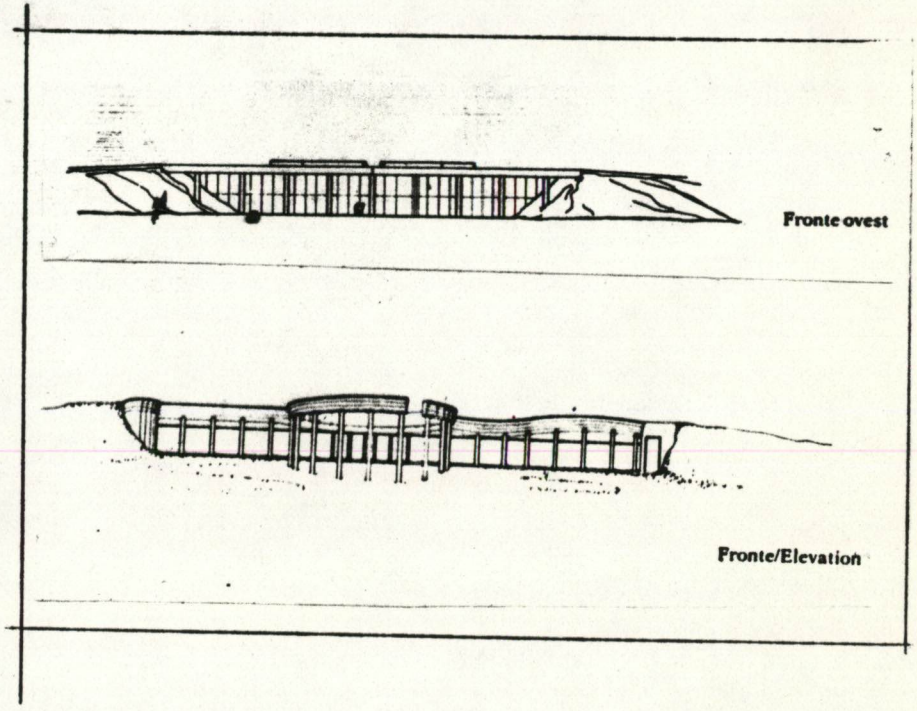
The large multi-purpose building is sited where north and south campuses meet. To unite and relate the two, the architect designed the main entry to open onto pedestrian paths which are "pulled" inside the building and become a system of streetlike, glass-roofed, double-height arcades opening directly into cafeteria, library and lectures and demonstration rooms. Three elevators provide accessiblity to all parts of the complex.

CASE STUDY

The Schlumberger Engineering Research Laboratory
Austin, Texas by Emilio Ambasz and Associates - 1982



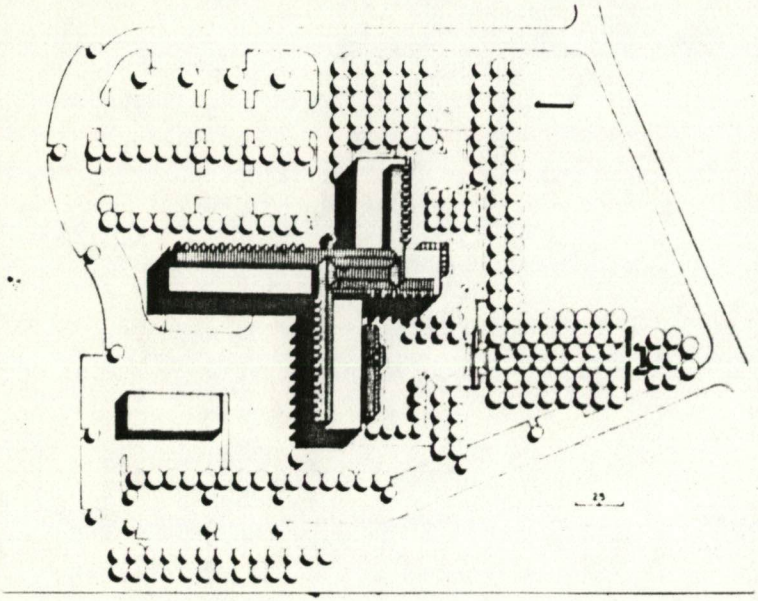


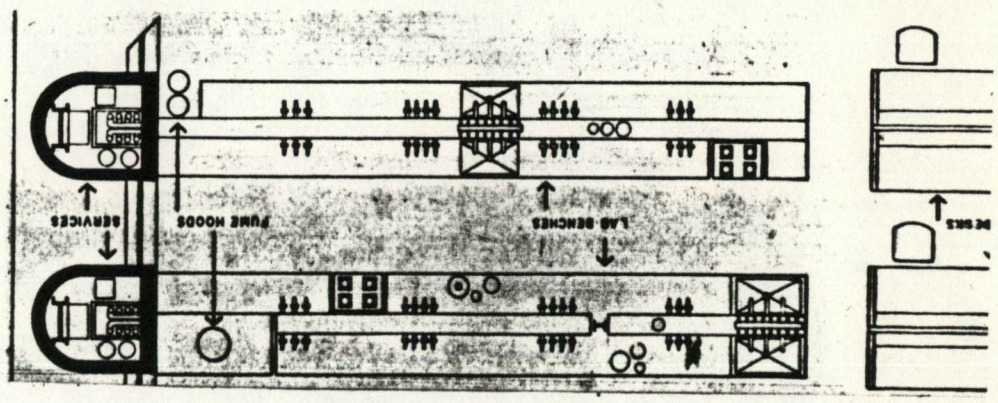


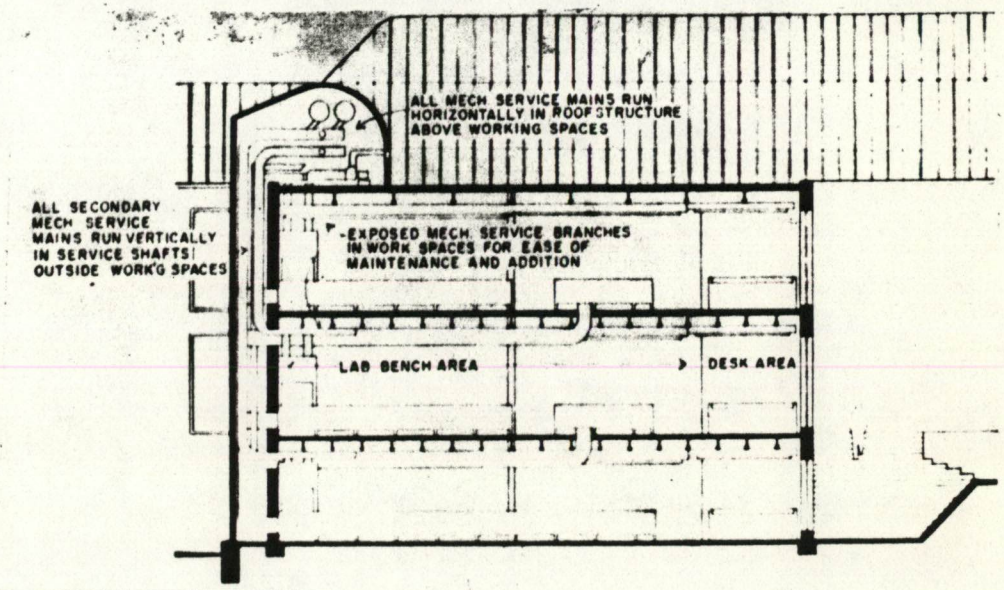
The Schlumberger Engineering Research Laboratory at Austin, Texas, includes, as in a sort of encyclopaedic epitome, signs and forms already tried out in various ways by Emilio Ambasz in previous projects. The result is a kind of "garden-text", a park scattered with objects produced for particular uses and a system of paths that link them and allow them to talk in the landscape. They are mildly emergent outlines or, conversely, massive and imposing in the strength of their ostentatious gravity. Sinuous and serpentine signs that follow the ground's undulations, or rigid geometrics imposed upon it by the stiffness of their conformation. A "map of memories,"--in the mind of the architect, who wanted to synthetize his whole repertory of favourite signs, and in the mind of the future visitor, who will be able, as he walks through well-devised spaces, to reconstruct the suggestions of those signs by re-connecting them to the exact individuality of his own "remembering".

CASE STUDY

A Research Center for Standard Brands
Wilton Connecticut by Warren Planter - 1980







The laboratory spaces in all four wings of the building are designed to the same plan--two thirds of the width of the wing is given over to laboratory tables, one-third to the central aisle and desk space for the technicians. On the laboratory-bench side, services are carried vertically by the rounded towers, led into the building at ceiling level for easy maintenance and change. Small windows between the towers offer some light and view, though the desk side of the space is wide open to the view. All of the exposed services are simply painted white, and the lighting is exposed bare-bulb fluorescent.

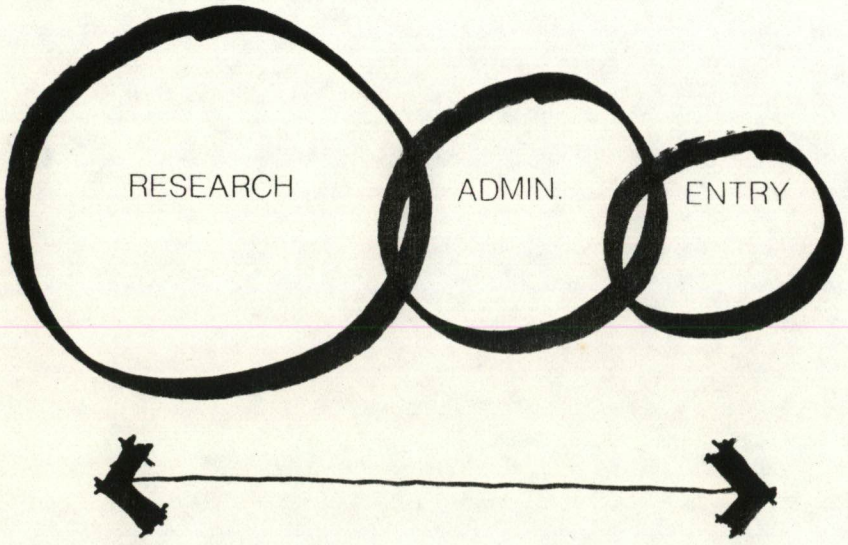
The maximum height permitted under zoning was 35 feet to the median height of a pitched roof--so the central part of the building has a pitched roof to get the above-median "bonus" height and the mechanical penthouse was thus fitted above the roof. Further, on the essentially flat site, sunken garden courts were dug out to create premium "ground floor" space from what would otherwise be basement space.

The Functions

THE FUNCTIONS

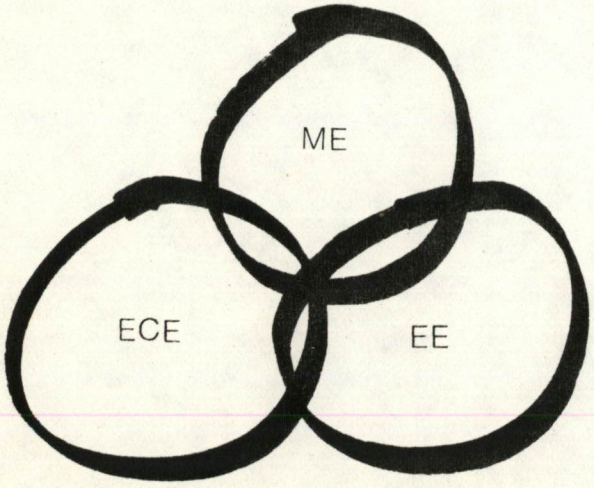
Administration

The administrative area is to house the department heads of both ECE and ME and also all faculty involved with the function of those departments. A direct relationship with the campus and pedestrian flow is desired as is a convenient relationship with the research area.



Research Laboratories

The laboratories of both Electrical, Computer and Mechanical Engineering are to be grouped in a manner as to facilitate the maximum amount of communication and interaction between research faculty in all the disciplines. This arrangement is desirable in order to promote cross-fertilization in research and thereby stimulate innovative design and research.



ECE Department

- Microelectronics

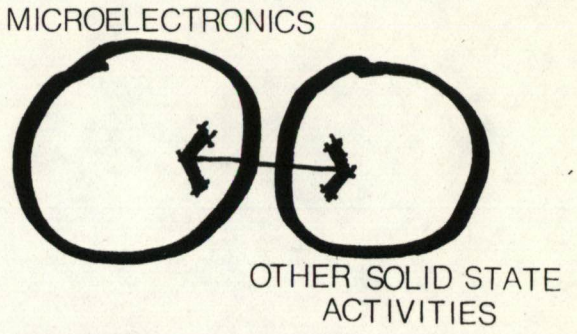
  Solid state design and research, to house clean room areas, dark room, fume hood and needs to be located close to other solid state design activities.

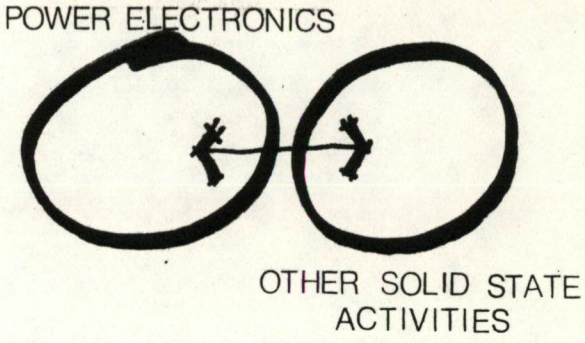
- Power electronics

  Design and research of systems and electronic devices which are to control or regulate large amounts of power.

- Signal Processing

  Computer hardware environment





- Computer communications

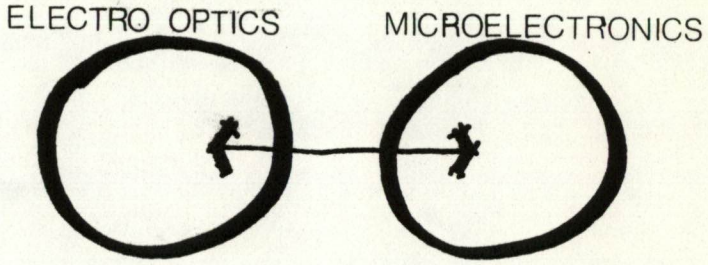
  Digital data transmission techniques, modems and communications software research. A close proximity to the graduate computer lab is desirable and a typical computer hardware environment is needed.

- Robotics

  High ceilings and computer hardware environment.

- Electro optics

  Vibrationless floors, 220v., water and warning light at entrance and should be located near Microelectronics.



- Computer systems

  Computer hardware environment

- Communications

  Computer hardware environment.

ME Department

- Thermal Science Lab

  2 Labs with adjoining graduate offices

- Hyperfiltration Lab

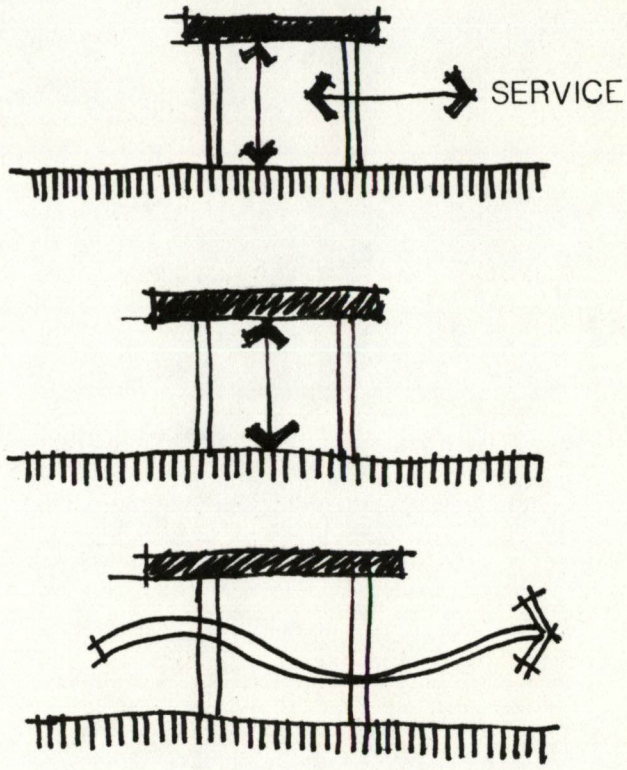
  12-14 foot high ceiling, access to outside service, fume hood and 220v power.

- Fluidized bed/Two-Phase Flow Laboratory

  2-story ceiling for crane operation and separate room for instrumentation.

- Combustion Laboratory

  ventilation



- Subsonic Wind Tunnel and Diffuser Laboratory

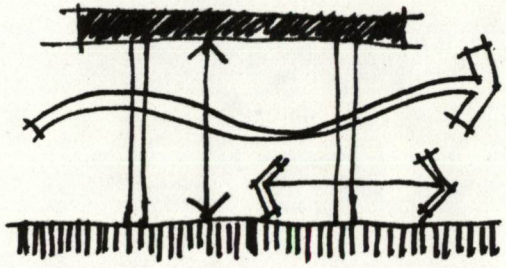
  Aerodynamic research, 440 v power and data acquisition facility.

- Alternate Energy Laboratory

  2 labs, one with a fume hood.

- Engine & Industrial Processes Laboratory

  Separate engine test cell, 2 story high ceiling for overhead crane, access to loading platform and good ventilation.



- Metallurgy Laboratory

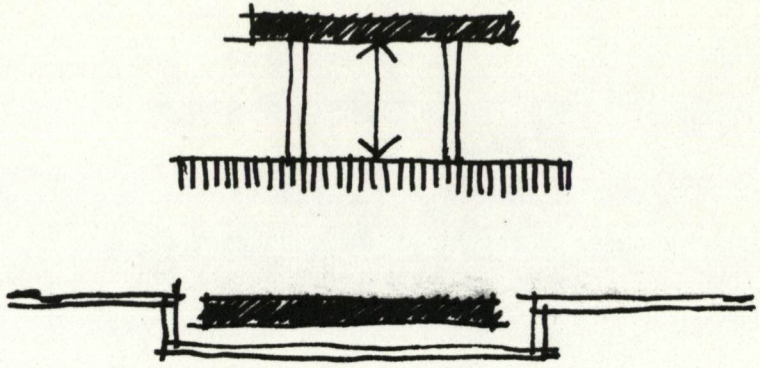
  3 labs with fume hood requirements and 440 v power.

- Composite Materials Laboratory

  12-14 foot high ceiling

- Dynamics and Oibration Laboratory

  vibrationless floors



- Robotics Laboratory

  220 and 330v power, fume hood,

  compressed air, vacuum

- Automated Manufacturing Laboratory

  computer room

  220 and 440v power, fume hood,

  compressed air, vacuum

- Special Projects Laboratory

  220 and 440v power, fume hood,

  compressed air, vacuum

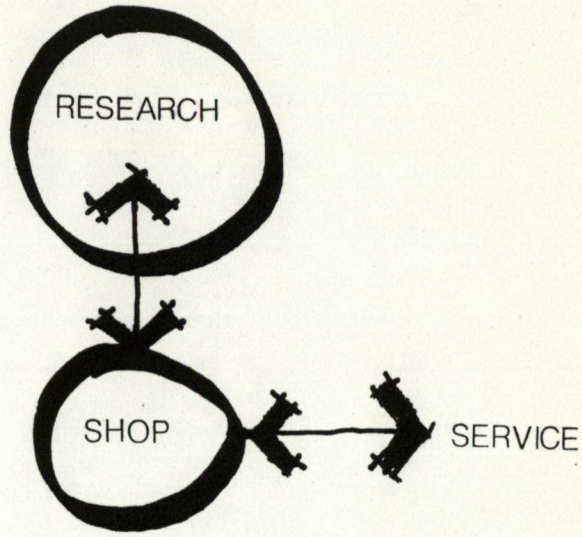
- Product Design Laboratory

  220 and 440v power, fume hood,

  compressed air, vacuum

SUPPORT FACILITIES

These facilities are to be used by the research areas to maintain and build equipment. A convenient relationship is needed to facilitate the transfer of equipment between Research Laboratories and Shop. Also the receiving and shipping of projects to and from the facility occurs in this area.



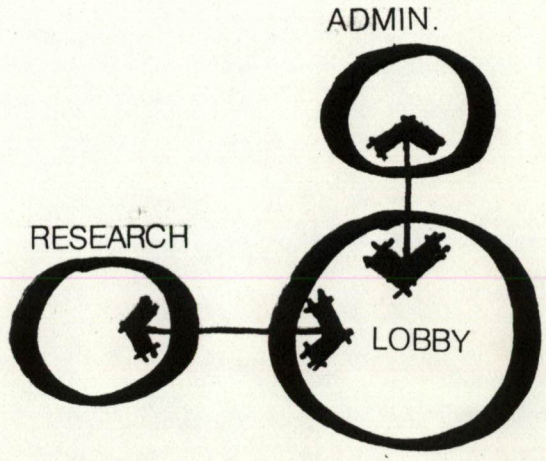
COMMON FACILITIES

Lounge

The lounge should create a pleasing environment for breaks--reading and interaction between faculty.

Reception/Lobby Area

The reception and lobby area should work as a collection and meeting point for those coming to the main entry of the facility for information or meetings. Access to the research area should be convenience and accessible from a separate entry point for faculty involved in research.



Space Requirements

SPACE ALLOCATIONS FOR CLEMSON UNIVERSITY
ENGINEERING RESEARCH AND ADMINISTRATION BUILDING

	Net	Gross
1. Administration		
ECE Dept. Administrative Offices		
Department Head	250	
Computer Eng. Program Office	350	
Elec. Eng. Program Office	350	
Secretary and Waiting	500	
Research & Grad. Program Office	350	
20 Faculty Offices @ 120 SF	2,400	
2 Grad. Research Offices @ 100 SF	200	
2 " Teaching " "	200	
Conference Rooms		
1 @ 400 SF	400	
1 @ 250 SF	250	
Storage	200	
	5,450	7,560
ME Dept. Administrative Offices		
Department Head	250	
Assistant Department Head	200	
Graduate Program Office	350	
Secretary & Waiting	500	
8 Faculty Offices @ 120 SF	960	
Conference Rooms		
1 @ 400 SF	400	
1 @ 250 SF	250	
5 Graduate Student Offices @ 100 SF	500	
5 PTA Offices @ 100 SF	500	
Storage	200	
Mechanical and Manufacturing Design Group		
15 Faculty Offices @ 120 SF	1,800	
2 Secretaries	400	
Storage	100	

Thermal/Fluid Science Group		
15 Faculty Offices @ 120 SF	1,800	
2 Secretaries	400	
Storage	100	
Conference Room	400	
	9,110	12,754

2. Research Laboratories

ECE Department		
Microelectronics	2,500	
Power Electronics	1,000	
Signal Processing	1,000	
Computer Communications	1,000	
Robotics	2,000	
Electro Optics	500	
Computer Systems	1,000	
Communications	1,000	
	10,000	14,000
ME Department		
Thermal/Fluid Science		
Thermal Science Lab		
2 Labs @ 1500 SF	3,000	
Graduate Offices	500	
Hyperfiltration Laboratory	500	
Fluidized Bed/Two Phase Flow Labs	500	
Combustion Labs	500	
Subsonic Wind Tunnels and Diffuser Labs	4,000	
Alternate Energy Lab		
1 @ 1,000 SF	1,000	
1 @ 500 SF	500	
Engine & Industrial Processes Lab	1,500	
Engineering Mechanics & Materials Engineering		
Metallurgy Lab		
2 @ 1,000 SF	2,000	
1 @ 500 SF	500	

Composite Materials Lab	1,000	
Dynamics and Olbration Lab	500	
Special Projects Lab	250	
Graduate Student Offices	500	
Mechanical and Manufacturing Systems Design		
Robotics	1,000	
Automated Manufacturing	1,000	
Computer Aided Design	1,000	
Special Projects	500	
Product Design	400	
Graduate Student Offices	1,000	
	21,750	30,450
3. Support Facilities		
Shop Area	1,500	
Storage and Loading Dock	500	
Calibration Lab	500	
Dark Room	150	
Technicians Offices		
3 @ 100 SF	300	
	2,950	4,130
4. Common Facilities		
Reception/Lobby Area	1,000	
Lounge	400	
Toilets		
Mens - 200 people X .5 SF	100	
Women's - 200 people X .8 SF	160	
Janitors' Closet		
4 @ 40 SF	160	
	1,820	2,548
TOTAL	51,080	71,512
5. Mechanical - 5% of Total Gross	3,575	5,005
GRAND TOTAL	54,655	76,517

Graphic Solution

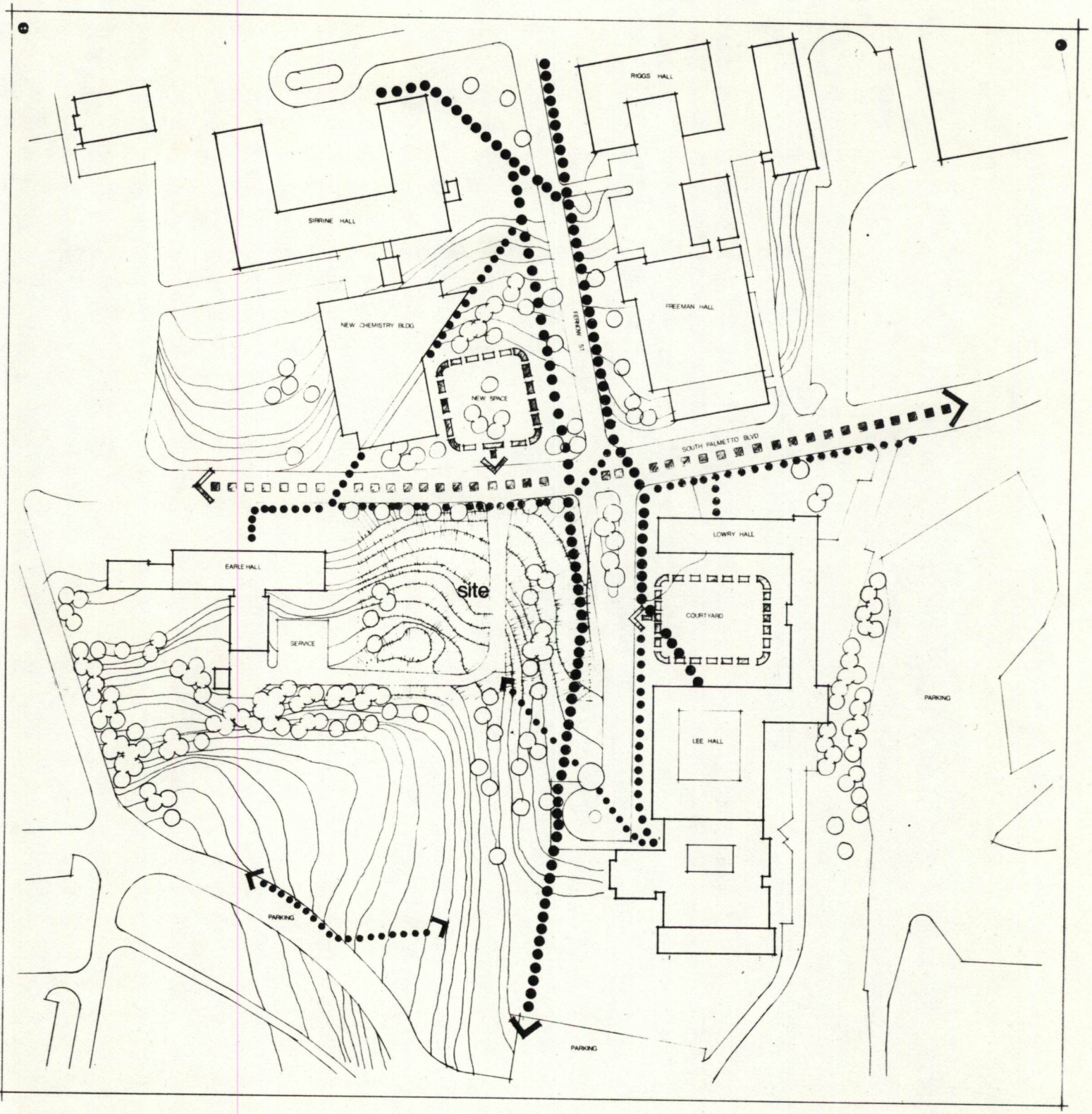
An Engineering Research and Administration Building for Clemson University

Scott Disher

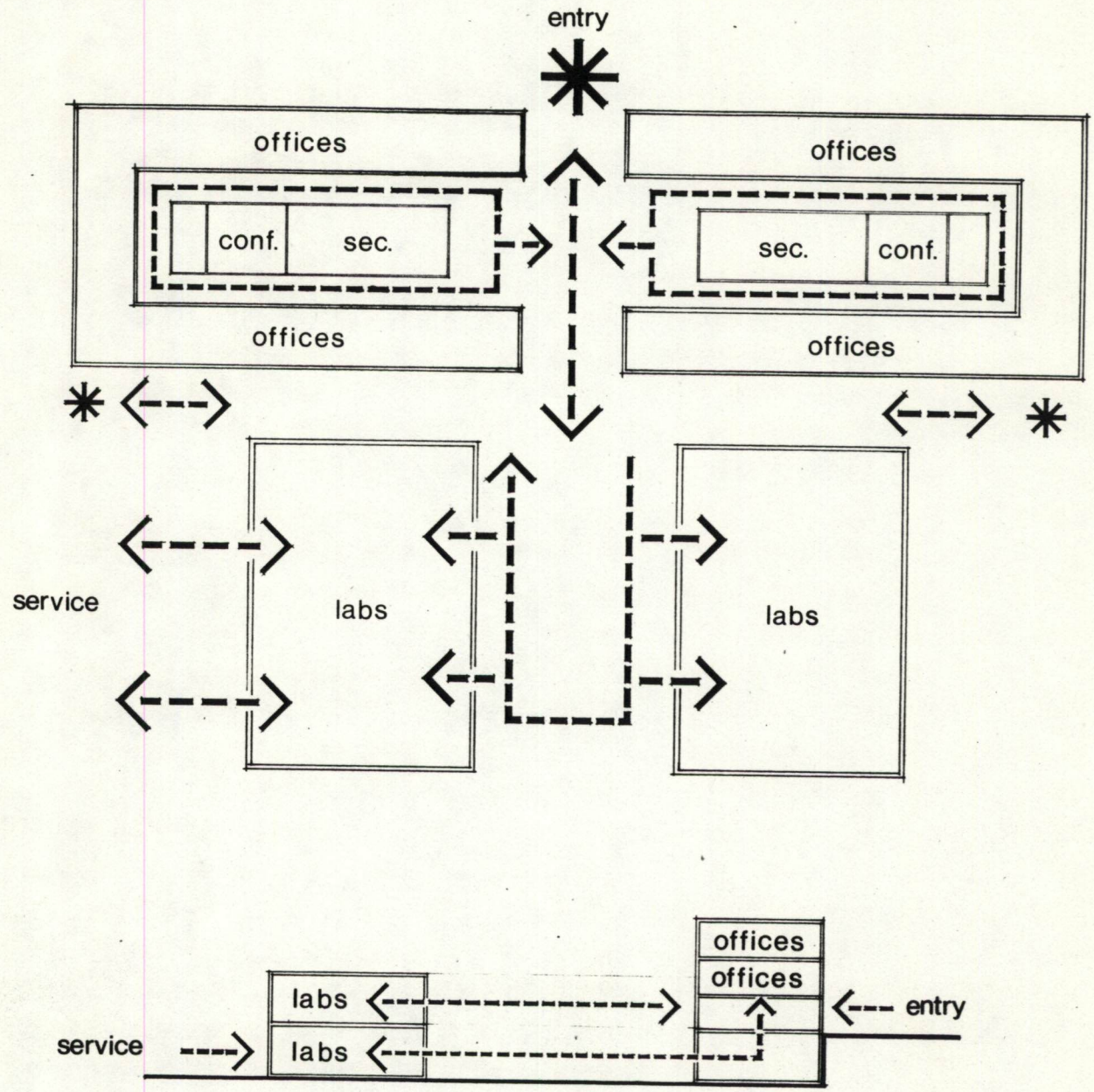
Spring 1984

A TERMINAL PROJECT SUBMITTED TO THE FACULTY OF THE COLLEGE OF ARCHITECTURE. CLEMSON UNIVERSITY AS PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF ARCHITECTURE.

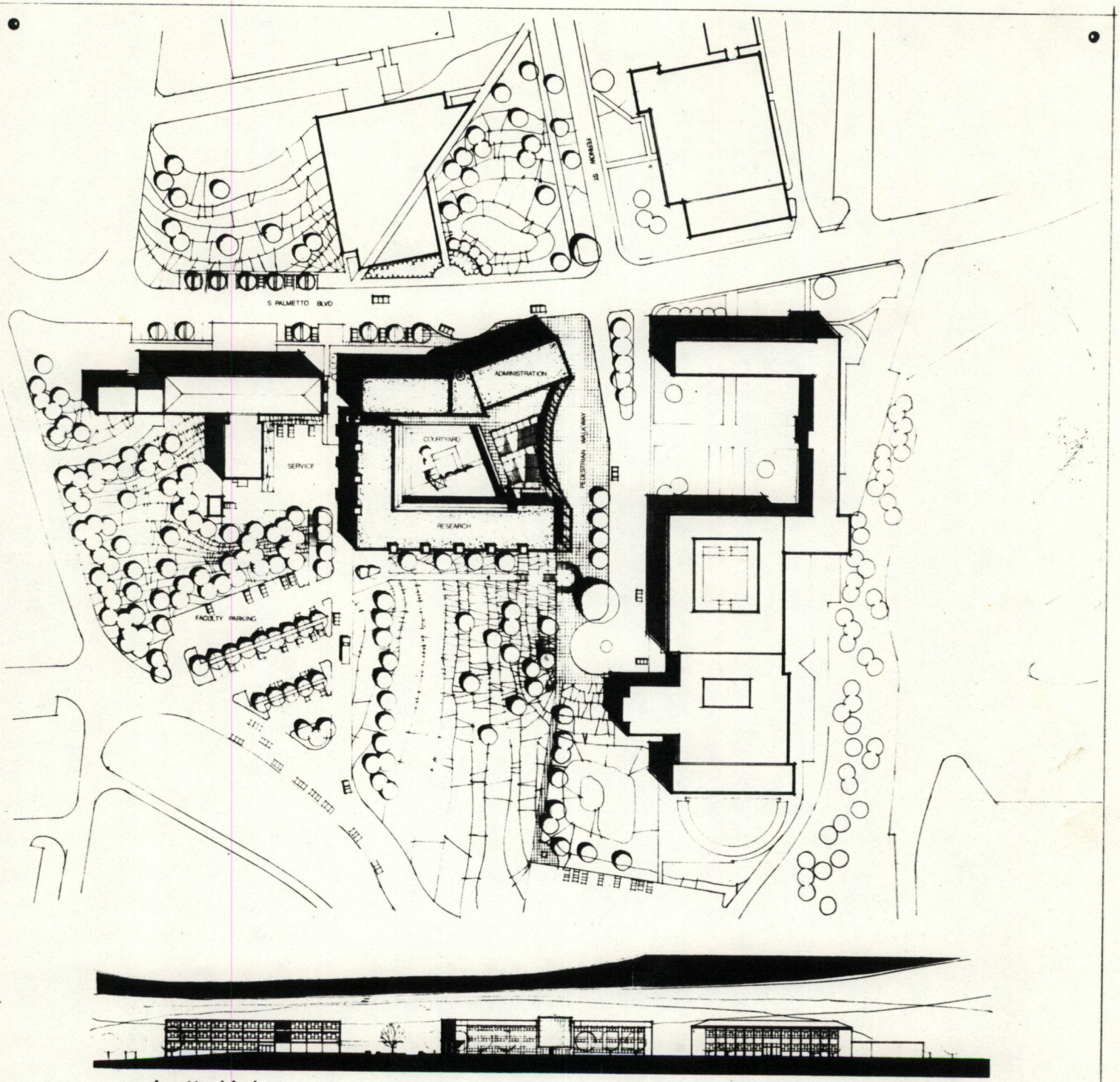
Scott Disher.



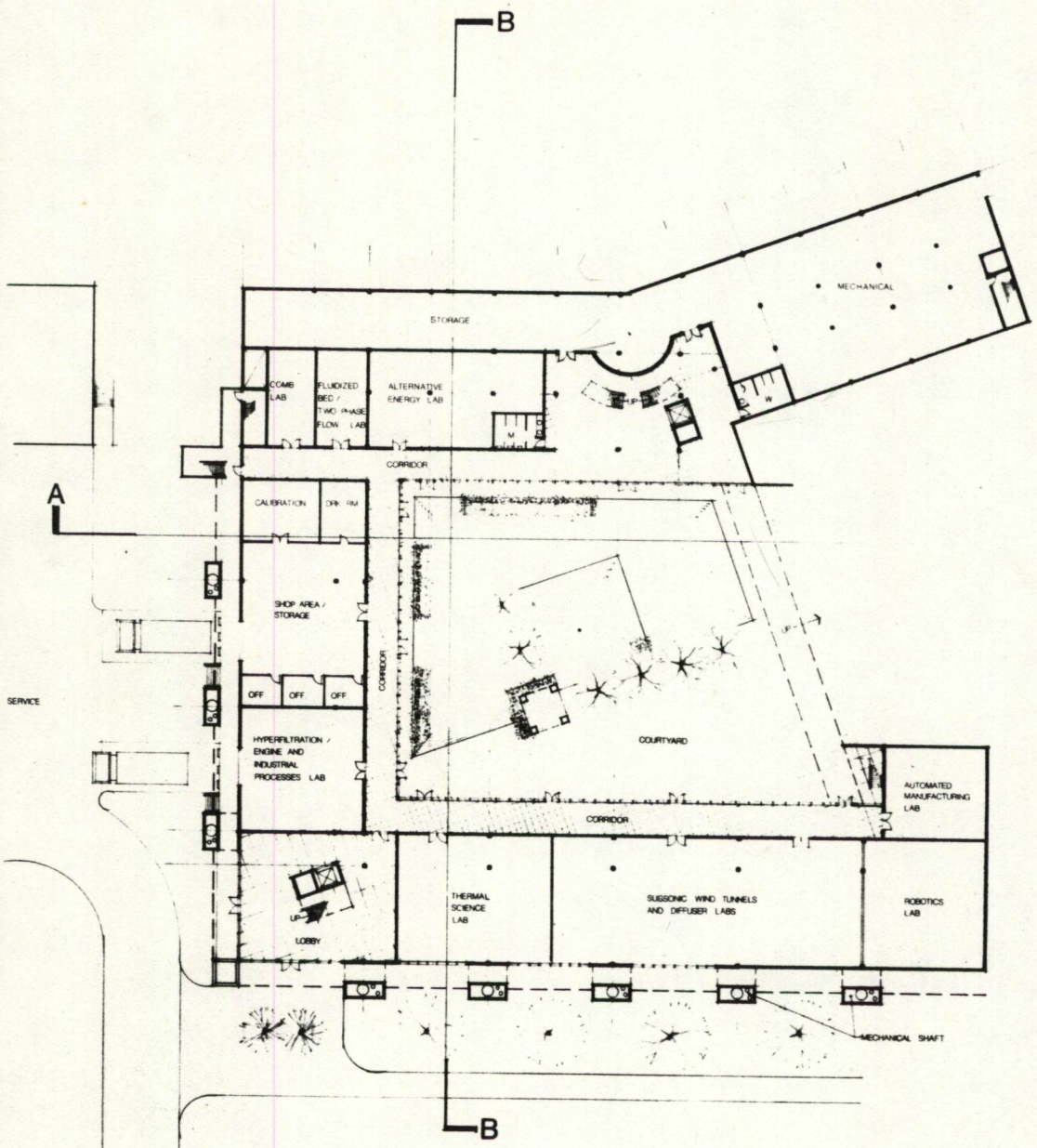
Site analysis



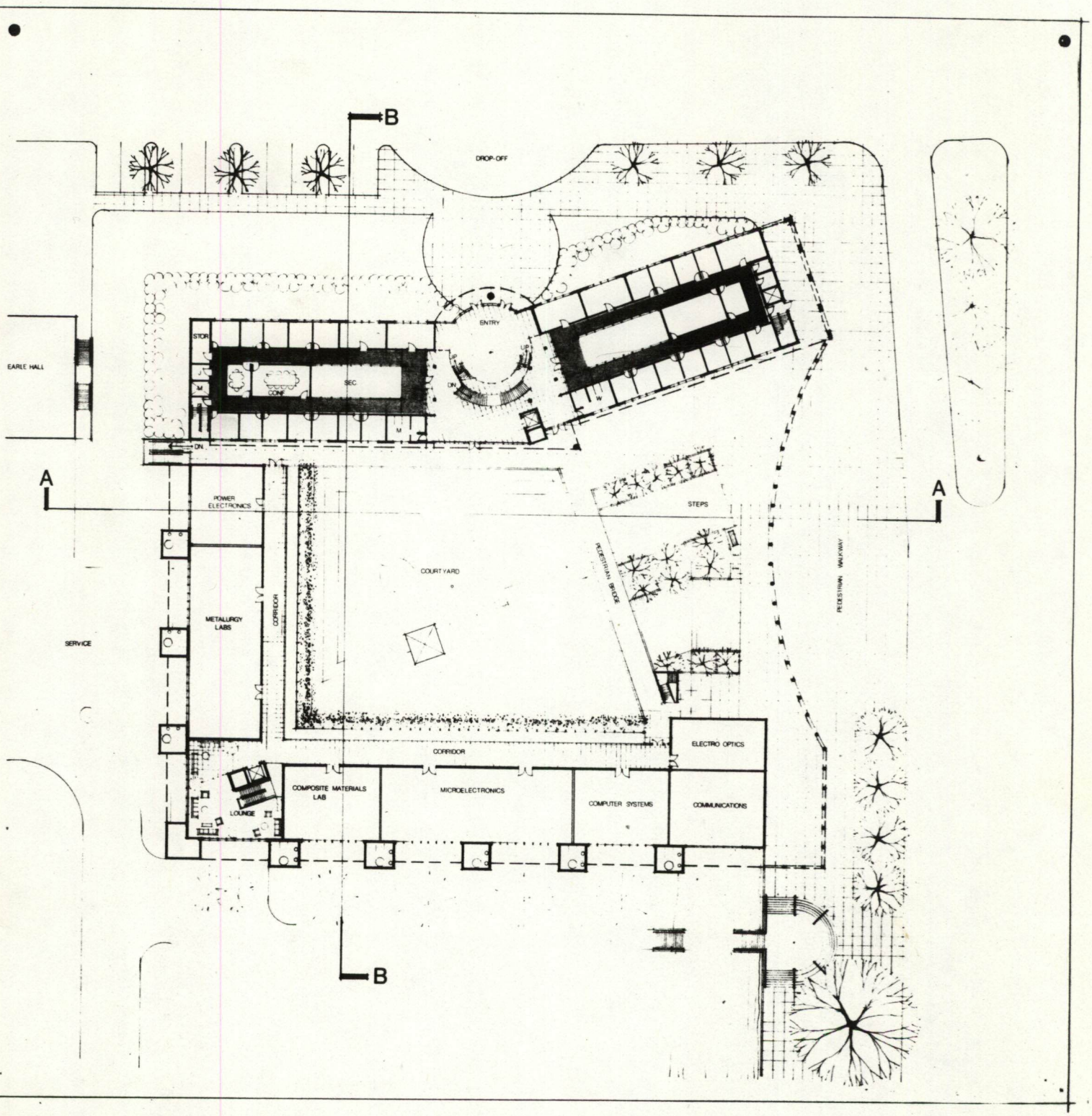
Diagramatic solution


S PALMETTO BLVD
FERNOW ST
ADMINISTRATION
COURTYARD
SERVICE
RESEARCH
PEDESTRIAN WALKWAY
FACULTY PARKING
palmetto blvd.

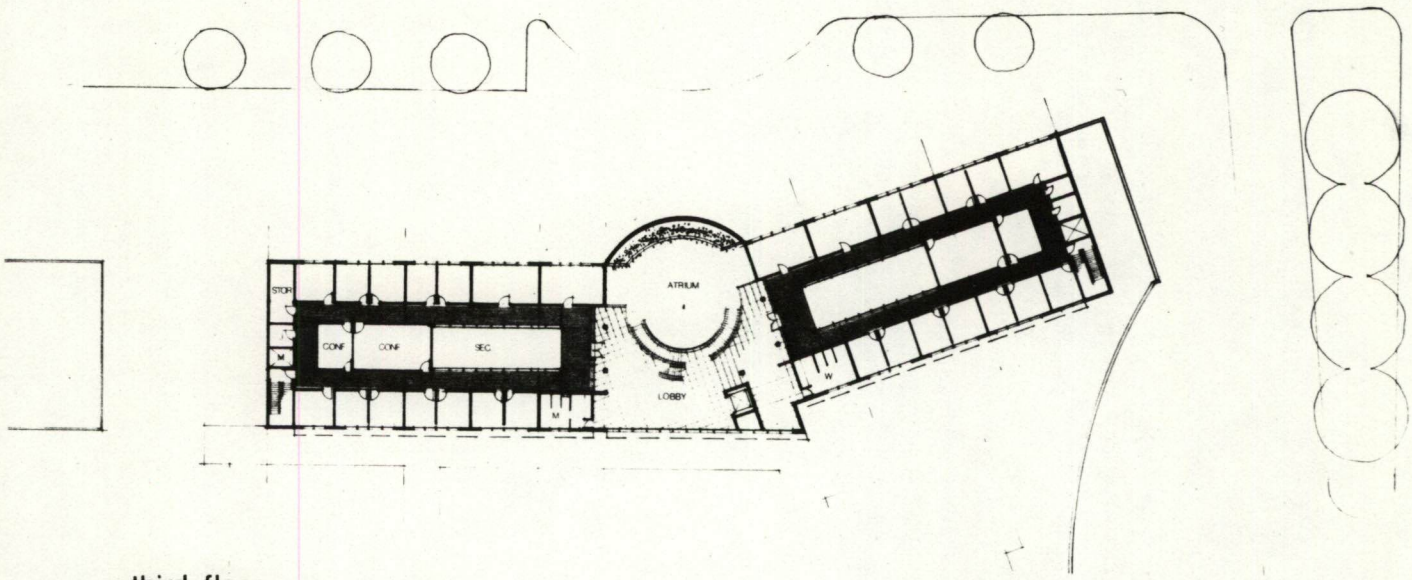
Site plan



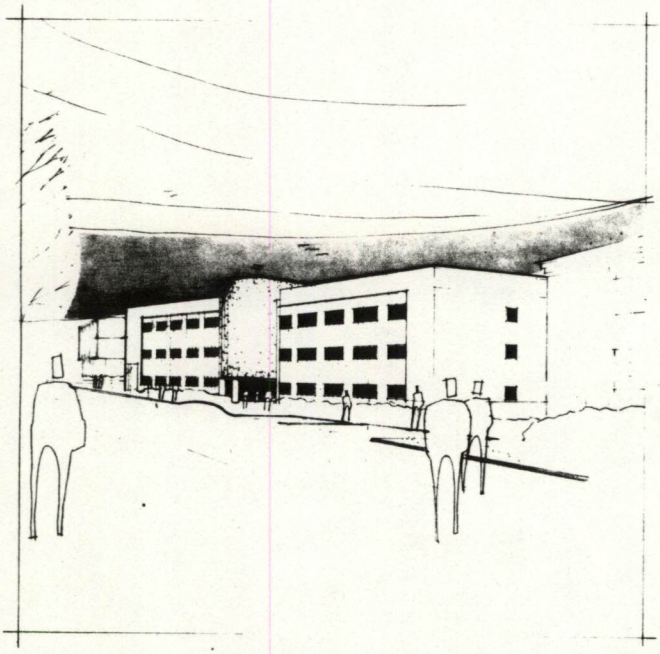
First floor plan

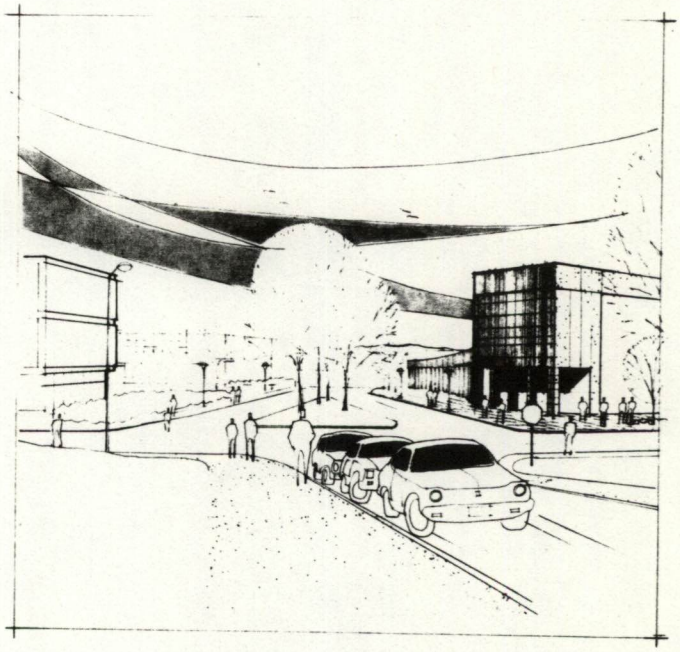


Second floor plan

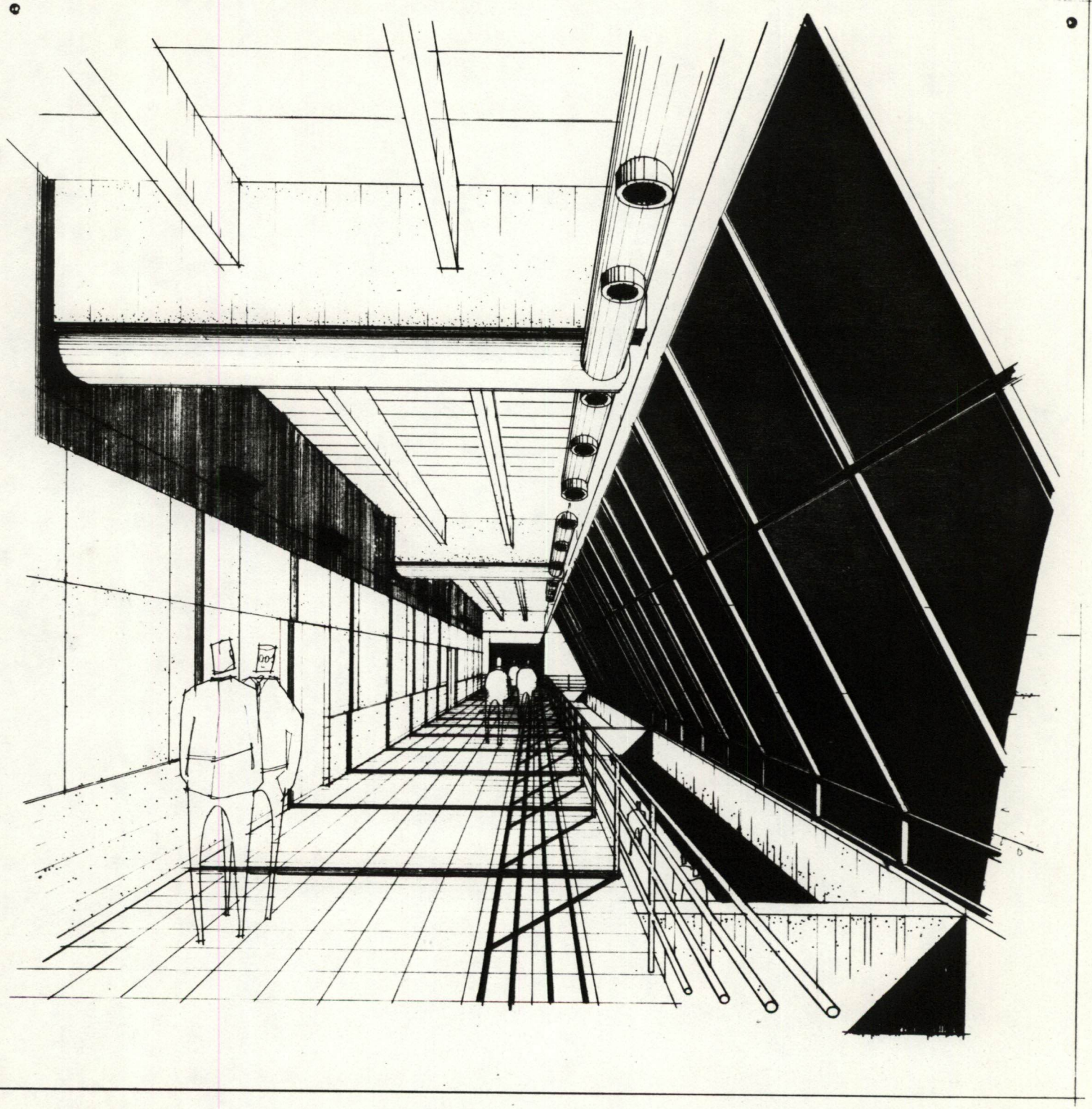


third floor

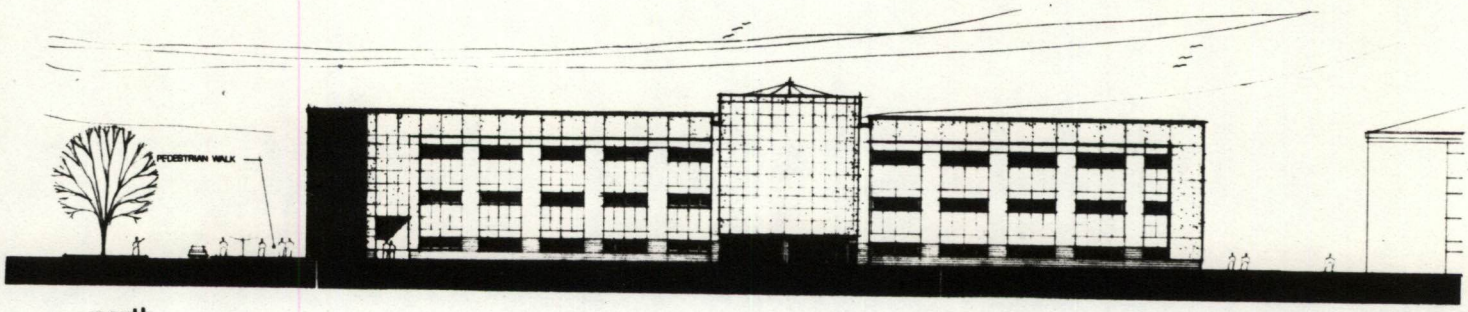




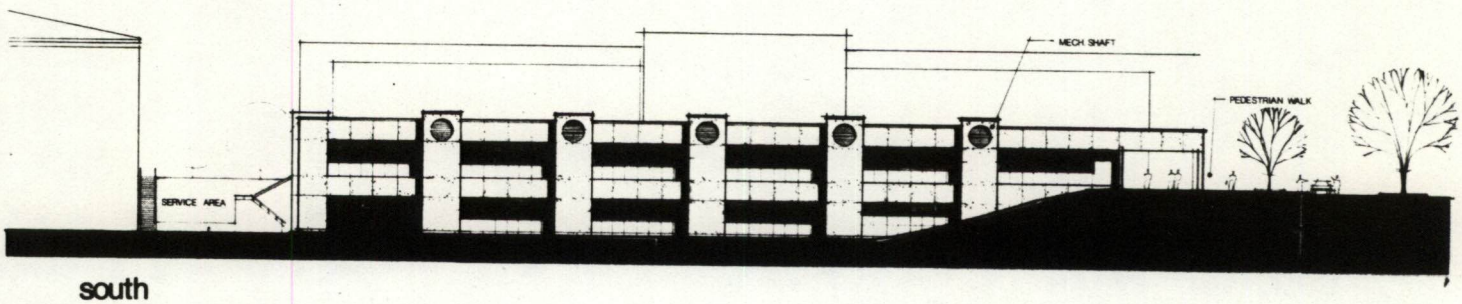
Plan / Perspectives



Corridor



north



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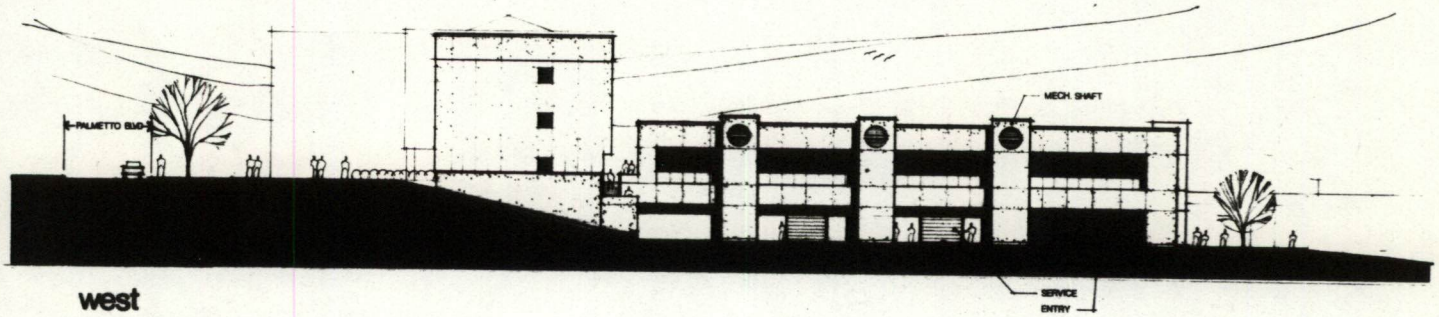
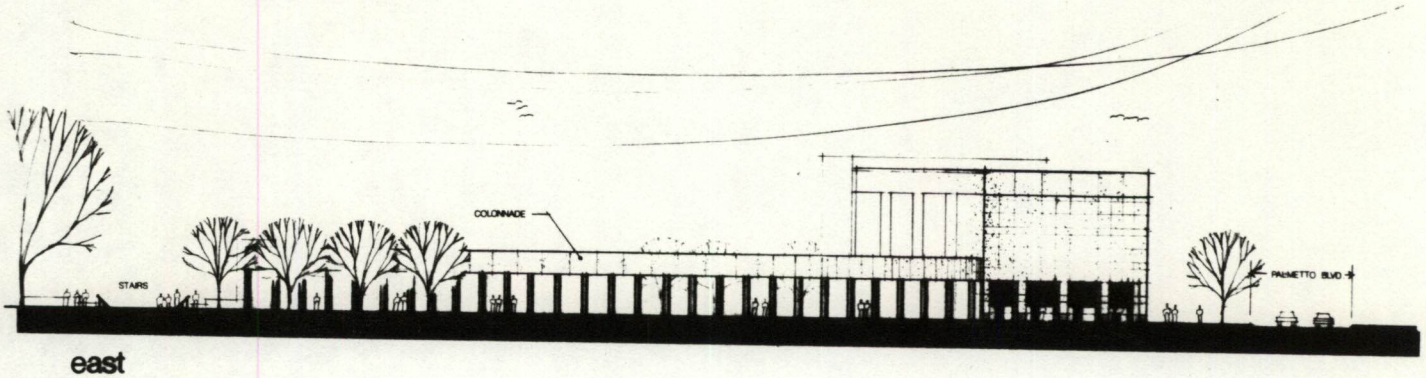


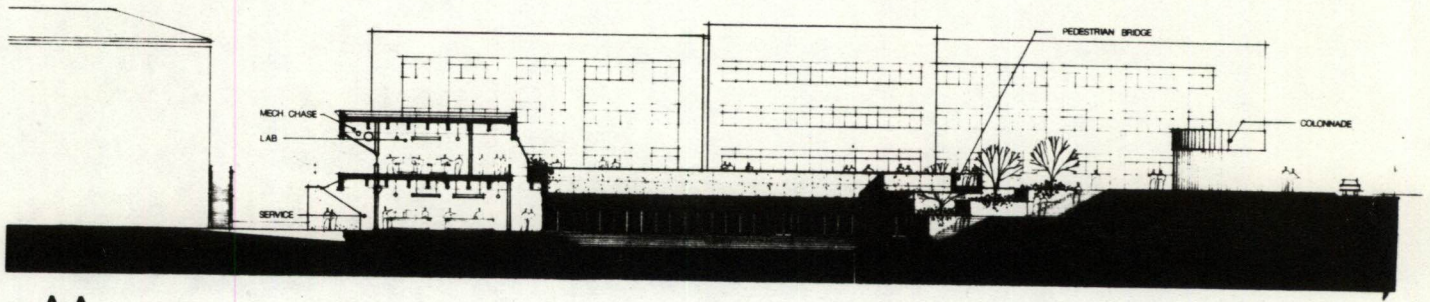
west

Elevations

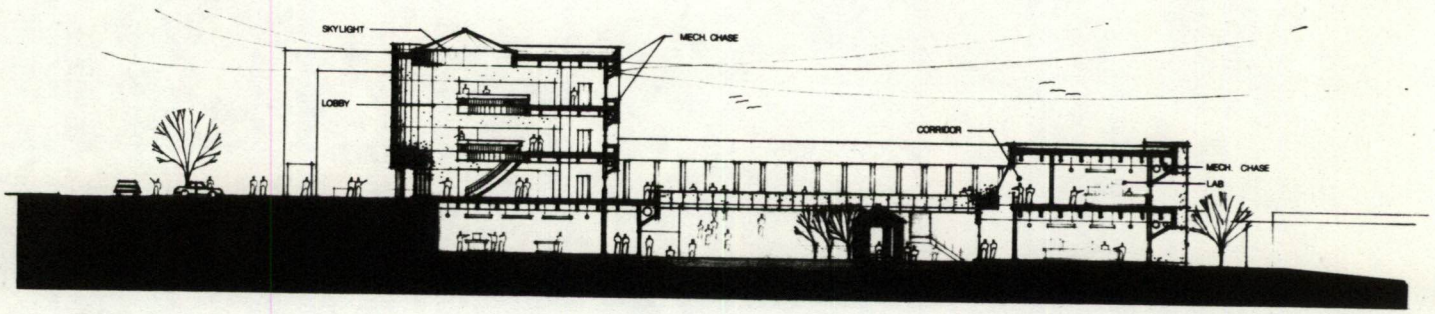
0 8 16 24



east

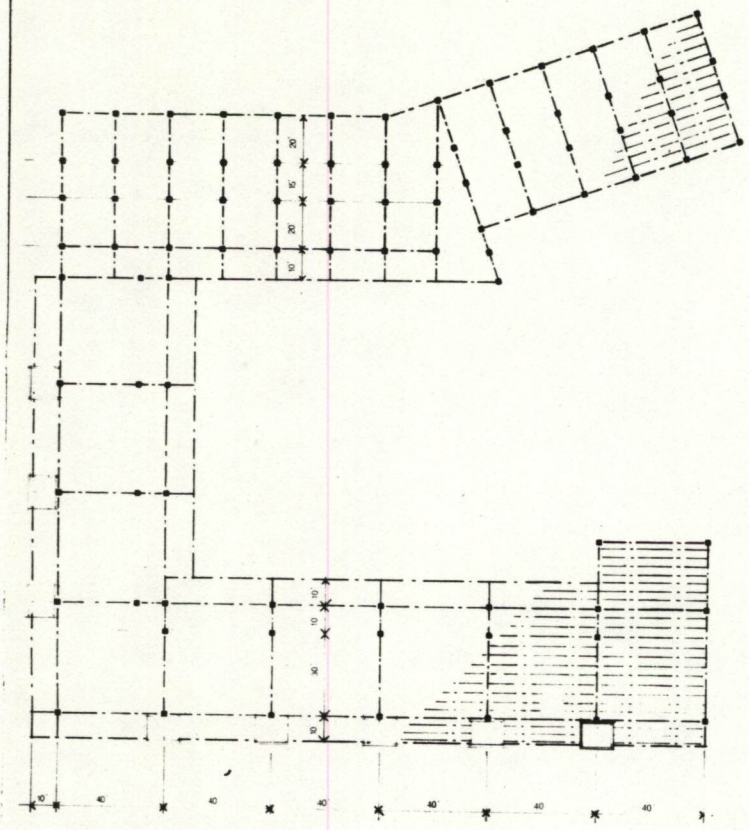


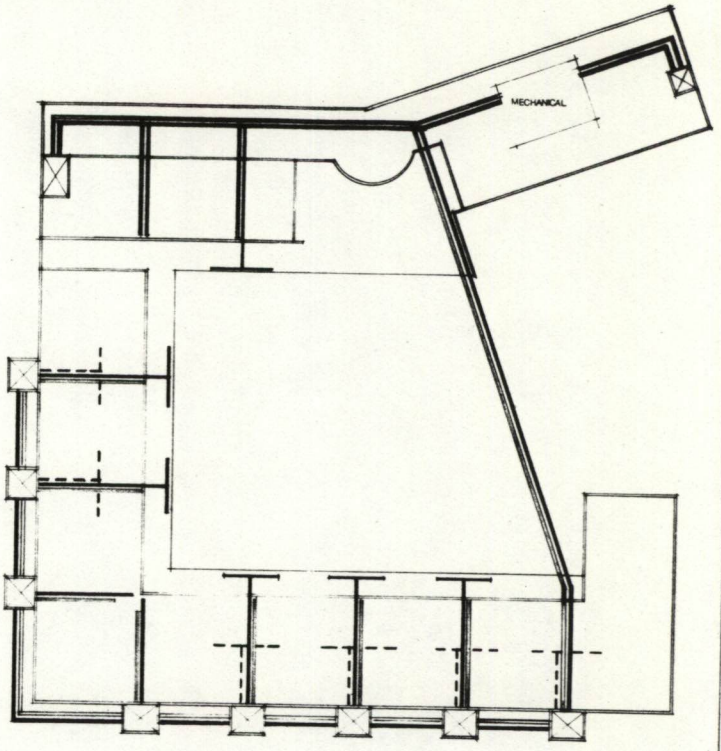
A·A



B·B

Elevation / Sections



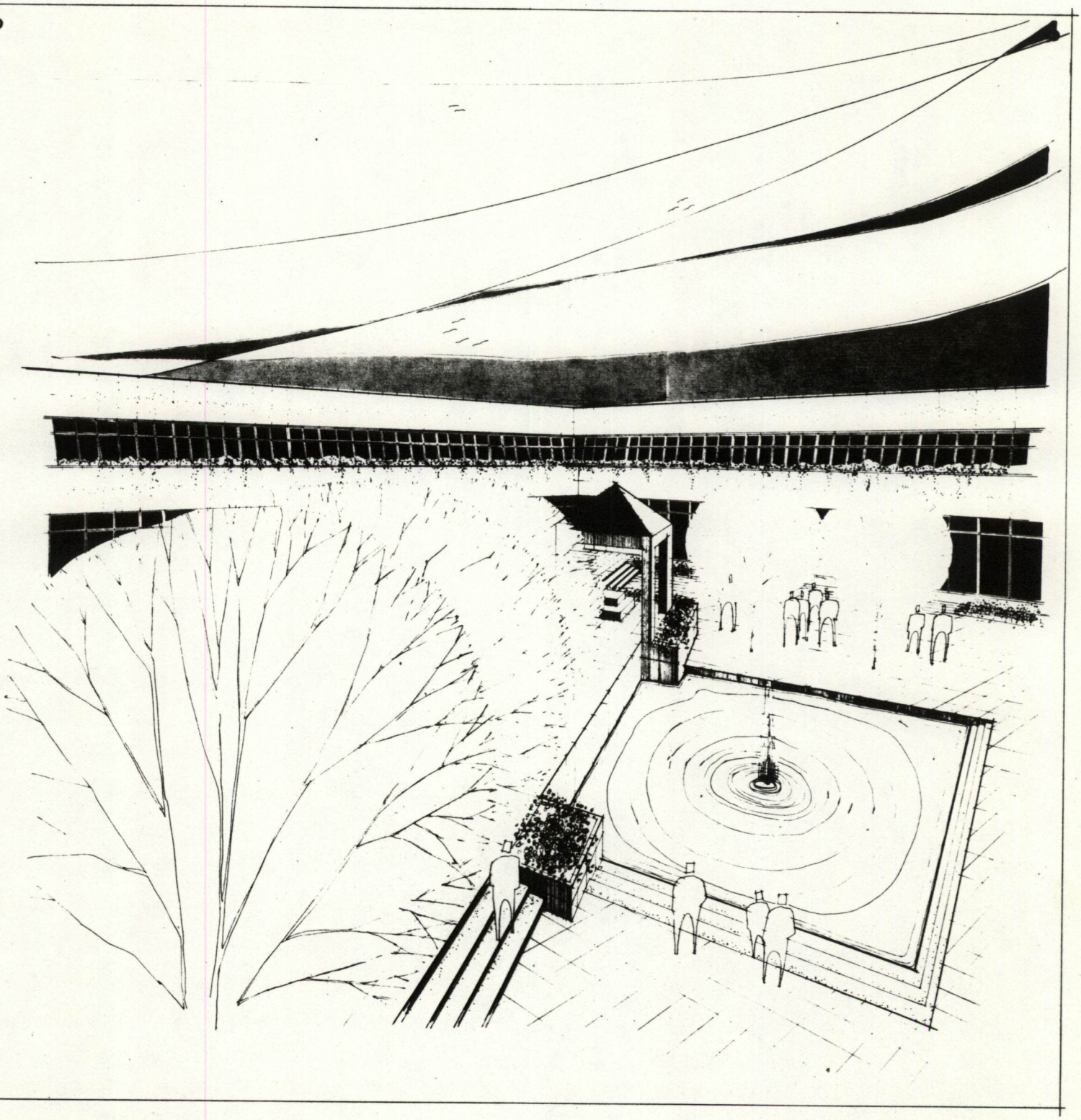


SUPPLY AIR
RETURN AIR
EXHAUST

Structural system

☐ POURED IN PLACE CONCRETE POST AND BEAM SYSTEM WITH CONCRETE HOLLOW-CORE PRE-FABRICATED ROOF DECK

Structural / Mechanical



Courtyard

RESOURCES

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